On Numerical Investigation of Semi-empirical Relations Representing Local Nusselt Number at Lower Nozzle-target Spacing's

By: Umair, SM (Umair, S. Mohd)[1]; Gulhane, NP (Gulhane, N. P.)[2]; Al-Robaian, ARA (Al-Robaian, A. R. A.)[3]; Khan, SA (Khan, S. A.)[4]

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Abstract

Examining the cooling rate using impingement of air jet finds a wide application in electronic packaging and micro-scale fluid heat interaction systems, While the prediction of Nusselt profile at low nozzle-target spacing is a big issue. The plot of area average Nusselt number magnitude against the nozzle-target spacing (Z/d) shows a gradual decrement in the profile upto Z/d = 1 and beyond that is steady. The present work aims in anticipating the profile of Nusselt number using semi-empirical relations. These semi-empirical relations are derived using using regression analysis which is carried out between Re, Z/d and local Nusselt number. The data required for regression are obtained through computation. Numerical simulations are accomplished for different impinging and geometric parameters. The semi-empirical power law relations are correlated between Z/d and Re. These are predicted differently for four distinct region of heat sink (stagnant point, near jet region, far jet region, near wall region). The developed correlations are found to bear negative exponent with Z/d and positive exponent with Re. The negative power of r/d and Z/d varies from 0.23-0.64 and 0.0025 0.38, respectively, While the exponents of Re varies in the positive range of 0.4-0.76.

Keywords

Author Keywords: Local Nusselt Number; Prandtl Number; Nozzel; Numerical Simulation; Heat Sink; Gamma-theta Model
KeyWords Plus: IMPINGING AIR-JET; HEAT-TRANSFER; FLAT SURFACE; IMPINGEMENT; SINKS

Author Information

Reprint Address: Umair, SM (reprint author)
MPSTME NMIMS Univ, Mumbai, Maharashtra, India.
Addresses:
[1] MPSTME NMIMS Univ, Mumbai, Maharashtra, India
[2] Veermata Jijabai Technol Inst, Mumbai, Maharashtra, India
[3] Qassim Univ, Buraydah, Saudi Arabia
[4] IIUM, Dept Mech Engn, Fac Engn, Kuala Lumpur, Malaysia
E-mail Addresses: umair.siddique@nmims.edu

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1 of 1

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Showing 18 of 18 **View All in Cited References page**